Final
Remedial Action Report

Elm Avenue Storm Drain Relocation and Groundwater Collection Trench

Atlantic Wood Industries Superfund Site
Portsmouth, Virginia

Prepared for

U.S. Environmental Protection Agency
Region 3
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Portsmouth, Virginia

Record of Preparation and Review

This Remedial Action (RA) Report has been prepared in accordance with the provisions of the Remedial Action Work Plan, dated 11 June 2012.

(b) (4)

RA Report Prepared by: Signature [redacted]

Name/Title (b) (4) [redacted], Project Manager

Date 9 July 2014

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RA Report Review by: Signature [redacted]

Name/Title (b) (4) [redacted] Vice President

Date 9 July 2014

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LIST OF ACRONYMS AND ABBREVIATIONS

AMI	Atlantic Metrocast Incorporated
AWI	Atlantic Wood Industries
bgs	Below ground surface
DNAPL	Dense non-aqueous phase liquid
EA	EA Engineering, Science, and Technology, Inc.
EASDR	Elm Avenue Storm Drain Relocation
EPA	U.S. Environmental Protection Agency
ft	Foot (feet)
GWCT	Groundwater collection trench
HDPE	High-density polyethylene
in.	Inch(es)
JB	Junction Box
O&M	Operation and maintenance
OSPW	Offshore sheet pile wall
OU	Operable unit
RA	Remedial action
RAC	Response Action Contract
RAR	Remedial Action Report
RCP	Reinforced concrete pipe
RD	Remedial design
ROD	Record of Decision
USACE	U.S. Army Corps of Engineers
VDOT	Virginia Department of Transportation
WA	Work Assignment

1. INTRODUCTION

This Remedial Action Report (RAR) has been developed by EA Engineering, Science, and Technology, Inc. (EA), as part of the scope of services required by the Remedial Action Work Plan, as authorized by Modification 0092 to Work Assignment (WA) No. 019RARA03L2 under U.S. Environmental Protection Agency (EPA), Region 3 Response Action Contract (RAC), Contract No. EP-S3-07-07, to provide remedial action (RA) services at the Atlantic Wood Industries (AWI) Superfund Site in Portsmouth, Virginia. This includes the tasks associated with the construction of the Elm Avenue Storm Drain Relocation and Groundwater Collection Trench (EASDR).

There are three operable units (OUs) at the AWI site: OU1 is the soil cover and dense non-aqueous phase liquid (DNAPL); OU2 is the groundwater; and OU3 is the contaminated sediments in the Southern Branch of the Elizabeth River. The EASDR is one of many components related to OU3. This document is limited to the RA for the EASDR.

1.1 SITE BACKGROUND

The AWI site includes approximately 48 acres of land on the industrialized waterfront area of Portsmouth, Virginia. The land is surrounded by the Norfolk Naval Shipyard (also a National Priorities List site), the operations center for the Portsmouth Public School District, the South Branch of the Elizabeth River, and several other small properties. From 1926 to 1992, a wood treating facility operated at the site using both creosote and pentachlorophenol, and operations included wood treatment, storage of wood, and disposal of wastes. The site was contaminated from the treatment operation, storage of treated wood, and disposal of wastes. At one time, the Navy leased a portion of the property from AWI and disposed of waste onsite, including used abrasive blast media from the sand blasting of naval equipment. The Navy also disposed of sludge from the production of acetylene in a wetland area on the border of the Southgate Annex of the Shipyard and the AWI site. As a result of site operations, sediments in the Southern Branch of the Elizabeth River contain visible creosote. The groundwater and soil at the site are also heavily contaminated with creosote.

Polycyclic aromatic hydrocarbons, pentachlorophenol, dioxins, and metals contamination (mainly arsenic, chromium, copper, lead, and zinc) have been detected in soils, groundwater, and sediments. A number of these contaminants have also been detected in stormwater runoff from the site.

Currently AWI, now known as Atlantic Metrocast, Inc. (AMI), operates a pre-stressed concrete products manufacturing facility on the site.

EPA selected a final remedy for the AWI site in the December 2007 Record of Decision (ROD). The selected remedy provides for the following components: a soil cover over the site, partial DNAPL consolidation and containment, monitored natural attenuation and groundwater monitoring, dredging of contaminated sediments in the river and sediment consolidation behind a new offshore sheet pile containment wall, and monitored natural recovery of the remaining undredged river sediments. Figure 1 provides the overall AWI Site Plan and identifies areas planned for remedial actions.

For the parts of the remedy that EA is designing, EPA directed that the remedial design for the AWI site would be divided into multiple design packages, based on individual remedy components. The remedial design for the EASDR was completed by EA in 2012. Other remedial designs for various remedy components were completed by EA in 2010-2014. These remedy components are listed below, with the dates of RA completion (or projected start) and the organization responsible for the managing the RA provided in parentheses:

- Soil Excavation Along Elm Avenue and the West Side Development (2011, EA)
- Offshore Sheet Pile Wall (2013, U.S. Army Corps of Engineers [USACE] Norfolk District)
- DNAPL Area consolidation and *In situ* Stabilization/Solidification (2013, USACE Norfolk District).
- East Side Containment Berm (ESCB) (2011, EA)
- Elm Avenue Storm Drain Relocation and Groundwater Collection Trench (2013, EA)
- Dredging and Dredged Material Handling (RA start 2014, USACE Norfolk District)
- Site Cover and Closure Activities (RA start 2016, EA)

The remedial actions listed in the first five bullets above must be constructed before the dredging begins since they are necessary to support the dredging and dredged material handling component by forming or impacting portions of two containment cells into which contaminated Elizabeth River sediments will be placed.

This RAR document is limited to a description of the activities associated with implementing the remedial design (RD) for the EASDR. Remedial designs or remedial actions for the other remedy components are not discussed in this document.

The EASDR was constructed in substantial accordance with the Final Design Contract Documents dated 9 August 2012. Variations to the design documents made during the RA are noted in Attachment A to this document, the Site Closure Report.

1.2 REMEDIAL ACTION REPORT ORGANIZATION

Chapter 2 of this RAR provides a summary discussion of the EASDR design and intent, construction activities, and lessons learned. Chapter 3 provides a timeline for the EASDR construction activities. Chapter 4 addresses operation and maintenance, Chapter 5 presents the EASDR RA costs, and Chapter 6 lists contact information for the various people involved with the EASDR RA.

Attachment A is the Site Closure Report developed by EA's RA subcontractor, WRScompass. This report (provided on a CD) contains more detailed information concerning the EASDR RA, including project photographs, daily reports, chemical and geotechnical data, as-built record drawings, and compaction testing results. This Site Closure Report was developed by WRScompass as a required submittal, and was reviewed and approved by EA. Attachment B provides the Final Inspection Punch Lists.

2. PRE-CONSTRUCTION AND CONSTRUCTION ACTIVITIES

2.1 INTENT AND SUMMARY OF THE REMEDIAL DESIGN

EA designed the EASDR to re-route the existing storm drain system along Elm Avenue. The relocation is necessary because the outfalls of the existing system are to the Wyckoff Inlet and the Northern Inlet; these outfalls will be unavailable due to the new land to be made by the dredging and consolidation of contaminated sediments behind the Offshore Sheet Pile Wall. The design process selected a relocated underground storm drain alignment that diverts across the AWI property, to an underwater outfall and discharge to the Elizabeth River just east of the restored wetland (see Figures 1 and 2). Some of the key design considerations of the EASDR are as follows:

- The EASDR was designed to be placed generally in a southeastern orientation on one public and two privately-held properties: the City of Portsmouth property (Elm Avenue and Veneer Road), the FIGG Bridge property, and the AMI property. There were also some minor impacts on the 3975 Elm Avenue property. The entire system was designed to be located just west of the finished location of the future dredged material Containment Area No. 1. Figure 2 shows the plan view of the EASDR from the remedial design.

- It was the general intent of the remedial design to keep the stormwater flow patterns north of Elm Avenue the same, with enhancements for future flow originating from the future dredged material Containment Area No. 1 made through the use of the junction boxes, increased pipe capacities, upgrading pipe materials (e.g., from corrugated metal to RCP), abandoning some existing pipes, and adding some new lengths of pipe, mainly in the vicinity of the Elm Avenue/Veneer Road intersection.

- Due to high groundwater elevations, is was necessary to specify a groundwater extraction and treatment system to lower the groundwater levels, so trench excavation and installation of the pipelines could proceed. The remedial action contractor designed the extraction and treatment systems, which were approved by EA through the submittal process.

- The relocated storm drain system is approximately 743 feet (ft) long and has varying depth from roughly 4 feet to 10 feet below ground surface (bgs).

- The design includes four large, poured-in-place concrete junction boxes (JBs) and one precast curb inlet at locations where the pipeline changes direction or connects to existing or new storm drain lines.

- Stormwater management components of the EASDR project were designed based on the finished condition of the dredged material containment area. Almost all of the surface drainage from the future containment cell will flow into the relocated storm drain system;

this is why the new system is so much larger than the existing system. The proposed EASDR includes triple 36-inch (in.)-diameter reinforced concrete pipes (RCPs) between Junction Boxes (JB) 1 and 2, double 36-in.-diameter RCP between JBs 2 and 4, and one 24-in.-diameter RCP between JB 4 and the curb inlet on the east side of Veneer Road. Again, the excess capacity is necessary to accommodate the large amount of surface runoff anticipated to be coming from the low-permeability cover gravel on completed Containment Area No. 1.

- Because the site is so flat, there will be standing water throughout most of the new storm drain system. During a storm, inflow to the system will cause the water levels in the pipelines to rise to the point where the head differential between the water in the pipelines and the water level of the river will allow three tide-flex valves at the underwater outfall to open and discharge to the river.

- In order to minimize the potential for infiltration of contaminated groundwater into the new pipeline system, the trench excavation was lined with 60-mil textured high-density polyethylene (HDPE). Following completion of the pipelines, the trench was flooded with clean water to eliminate the pressure gradient that would facilitate flow of contaminated groundwater outside the trench towards the trench.

- The design incorporated four drainage lines (two upper and two lower) and two monitoring ports north of JB 1 to assess the water level inside the trench and to potentially drain the lined trench if necessary.

- The design also included a passive groundwater collection trench (GWCT) parallel to and just west of the relocated storm drain system. This underground, gravel-filled trench is intended to assess groundwater conditions and potentially provide for a future extraction system following completion of the Containment Area No. 1. There is a monitoring port at the southern end of the GWCT.

The design included a 22-sheet drawing set, specifications, design report, and engineer's estimate. Geoff Tizard, P.E. of EA, a professional engineer licensed in the Commonwealth of Virginia, signed and sealed the drawings on 9 August 2012. The organization chart for the EASDR RA is presented in Figure 3.

2.2 CONSTRUCTION ACTIVITIES

This section provides a general discussion of the construction phase activities. Additional, more detailed narrative of the RA process is included in the Site Closure Report developed by WRScompass and included with this RAR as Attachment A.

Following a competitive procurement process, onsite pre-construction meeting, and approval of pre-construction submittals, WRScompass mobilized to the site during the first week of January 2013. Following consultation with the property owners, site trailers and staging areas were

placed on the northern portion of the AMI property. Access for site workers and material deliveries was made from Elm Avenue across the FIGG Bridge property and onto the AMI property (see Figure 1). Environmental protection included limited silt fencing, small surface berms, and stabilized construction entrances.
It should be noted that USACE-Norfolk District was managing construction activities for the final portions of the offshore sheet pile wall (OSPW) during the first half of 2013. This meant that EA and WRScompass had to work in close proximity to USACE and their RA contractor, McLean Contracting, during most of the EASDR RA, especially during installation of JB 1, when McLean was completing the OSPW and the pile cap on the Southern Bulkhead portion of the OSPW. All parties communicated well with each other and things generally went smoothly. Vince Barber, EA's Onsite Inspector, was instrumental in this role.

Following placement of erosion and sediment controls, WRScompass began installation of the groundwater extraction system, which included two rows of well points on either side of the proposed pipeline excavation and header collection pipes to move the extracted groundwater to frac tanks. Concurrently with this activity, the groundwater treatment plant was mobilized to the site and set up in an open area east of the pipeline trench alignment. Groundwater treatment included a weir tank, bag filters, and carbon filtration. Later in the project, WRScompass added a zeolite filter to improve the quality of the effluent. Initial batches of contaminated groundwater were passed through the treatment system and held in other frac tanks while analysis of the effluent was completed to verify that that system met the discharge criteria in the specification. Once these limits were achieved, the treatment plant effluent was discharged to the Northern Inlet. As work progressed from south to north, the groundwater extraction system was shifted as well. Additional well points were installed and the headers and pumps relocated to the new locations. Over the life of the groundwater extraction and treatment system, a total of 2,502,347 gallons of treated water were discharged to the Elizabeth River.

<u>Junction Boxes</u>

During the excavation for JB 1, an unexpected amount of water was impacting the excavation. Following investigation, EA concluded that this was due to the tidal effect of being approximately 60 ft from the Elizabeth River to the south and 150 ft from the river to the east. WRScompass provided a sump pump to control this additional groundwater inflow, which was discharged through a filter sack and released to the lagoon behind the newly-completed OSPW. It was then discovered that the three 42-in.-diameter steel pipes placed by McLean as part of the OSPW construction deviated several inches from the locations on the EASDR design drawings. EA investigated this situation and provided revised corner of slab coordinates that slightly shifted and rotated JB 1 to better align with the as-built conditions of the 42-in. steel pipes. As recommended by EA's subcontracted geotechnical engineer (Schnabel Engineering), soft subgrade conditions required that rock be placed under the slab of JB to stabilize the subgrade prior to placement of the bottom slab of JB 1. Construction of JB 1 continued in the following sequence:

- Formwork, reinforcing bar, and concrete for the bottom slab

- Formwork, reinforcing bar, and concrete for the walls
- Formwork, reinforcing bar, and concrete for the top slab (roof)
- Installation of the access hatches.

This general sequence of construction was followed for the remaining three JBs. As recommended by EA's subcontracted geotechnical engineer, JBs 2 and 4 required stone subgrade stabilization; JB 3 did not. JBs 3 and 4 were constructed with drainage grates instead of access hatches in the top slabs.

During the forming of the walls, EPA and EA decided to replace the knockout for a future pipe connection in the junction boxes with one pre-placed segment of RCP. This change affected both JBs 1 and 2, and resulted in Contract Modification 1 to WRScompass' subcontract with EA. Shop drawings of these "stub outs" are provided in Appendix E (CD) to Attachment A, the Site Closure Report.

During the erection of formwork for JB 1, the three sections of 42-in.-diameter steel pipe were installed between the south side of JB 1 and the three existing pre-placed steel pipes installed by McLean. The joints between the pipes were made via identical flanges on both sets of pipe. However, since WRScompass had already secured the north ends of the 42-in diameter steel pipes within the concrete wall of JB #1 before connecting the south ends to the pre-placed steel pipes installed by McLean, the flanged connection between the two sets of pipe could not be adequately sealed and began to leak a small amount to water, despite the presence of a gasket at the flanged connection. WRScompass attempted to eliminate the leakage through the use of caulking and the use of a flexible wrap material installed over the flanges, but these initial remedies were not successful in stopping the leak. This leakage was ultimately rectified by WRScompass with the installation of flexible rubber gaskets, known as Weko-seals. These flexible seals were installed on the inside of each steel pipe and held in placed with compression band-clamps by divers accessing the pipe joints from the open outfalls in the river in October 2013. This successful effort to stop the leaks was made by WRScompass at no extra cost to the government.

During construction of JB 4, WRScompass connected an existing 15-in. RCP coming from a curb inlet on the west side of Veneer Road to JB 4. During this effort, EA observed that there was sheen within an adjacent existing manhole in Veneer Road that also drained to the curb inlet. This manhole was constructed with brick and was in poor condition. Further investigation revealed that:

- the manhole was also connected to the existing storm drain pipe on the west side of Veneer Road
- the manhole had creosote deposits in the bottom
- the pipeline just upstream (north) of the manhole was blocked and likely damaged, restricting flow to the manhole.

Concerned that contamination was entering the manhole from the dilapidated brick walls, EPA replaced the brick structure with a precast concrete manhole under a contract action separate from this RA. Following installation, it was observed that sheen was still entering the manhole from upstream. To restrict contamination from reaching the new storm drain, the pipe from the new manhole to the curb inlet was plugged.

Trench Excavation

While work on JB 1 continued, excavation on the pipeline trench to the north toward JB 2 began. The excavated trench was trapezoidal in shape and was excavated to the depths and grades shown on the design drawings. The trench was lined with a "sandwich" of non-woven geotextile, a synthetic liner (HDPE), and an overlying layer of non-woven geotextile. This liner system terminated in an anchor trench that ran along both sides of the excavation. Following installation of the liner sandwich, stone pipe bedding was placed in the trench.

The dewatering system was generally successful in keeping the excavated trench dry so construction activities could continue, although sump pumps were occasionally used to augment the dewatering effort. As work progressed northward, the amount of stained soil and product seeps increased, culminating in free product present in the excavation around JB 4. Based on the existing site characterization, this was not unexpected, and the contaminated groundwater and free product was collected and run through the groundwater treatment plant.

During excavation and removal of an existing 24-in. RCP storm drain, it was discovered that the pipe was in fact asbestos concrete pipe, not RCP. WRScompass responded to this situation by restricting laborers working in the area to those with proper asbestos training and respiratory equipment, and wrapping all lengths of the excavated asbestos pipe in polyethylene. All asbestos pipe was then relocated to Stockpile Area A west of Burton's Point Road. The removal of the asbestos pipe resulted in Contract Modification 2 to WRScompass' subcontract with EA. EPA took over responsibility for the final disposition of these pipes.

Pipeline Construction

Once the walls of JB 1 were completed, work began on laying the three 36-in.-diameter RCP pipelines northward to JB 2. Each of the three side-by-side pipelines progressed concurrently so backfilling operations could be initiated once there were approximately four pipe lengths installed. The connection between the pipelines and the junction boxes were filled with a combination of brick and non-shrink grout to provide a water-tight seal. The four HDPE trench drains (two lower and two upper) and two monitoring ports were installed in the trench per the design drawings prior to backfilling with stone and select fill. Finally, low permeability gravel was installed as a finish surface. Work progressed in this fashion from south to north until the curb inlet on Veneer Road was reached. The curb inlet on Veneer Road was the end of the relocated Elm Avenue storm drain system. In accordance with the design documents, the RCP pipe between JB 1 and 2 was Class IV pipe, while the remainder of the RCP installed during the project was Class III pipe.

Later in the project, EPA directed that three galvanized steel trash grates be placed on the southern wall within JB 1, immediately upstream of the three tide flex valves. These trash grates are intended to prevent large pieces of debris from damaging the tide flex valves. This change resulted in Contract Modification 3 to WRScompass' subcontract with EA. WRScompass' had the three galvanized steel trash grates fabricated and installed them in September 2013.

Relocation of Existing Utilities

Trenching and pipeline construction activities were temporarily halted on 24 June 2013 at approximately Station 5+90, just east of the location of JB 3. WRScompass needed to relocate the existing utilities under Elm Avenue and Veneer Road before pipeline work could be continued. As per the remedial design, existing utilities underneath Elm Avenue and Veneer Road had to be relocated to a deeper elevation so that the new storm drain pipelines could pass over them.

WRScompass raised the issue of access to EA in mid-April 2013, believing that the entire intersection would need to be closed in order for the utility relocations to be made. In mid-May 2013, EA approached the 3971/3975 Elm Avenue property owner about the possibility of installing a temporary by-pass road across his 3971 Elm Avenue property so the entire Elm Avenue/Veneer Road intersection could be closed. The 3975 Elm Avenue property owner refused this request. At the end of May, WRScompass then attempted to negotiate an agreement with the 3971/3975 Elm Avenue property owner, but this effort was also denied. WRScompass then proceeded to plan the utility relocations according to the requirements of the RD, which stipulated that one lane of traffic must be kept open at all times.

In late July 2013, a temporary bypass road was constructed on FIGG and AMI property which allowed traffic to continue south on Veneer Road, cross over Elm Avenue, and turn west for a short distance, then re-enter Elm Avenue west of area impacted by construction activities; construction of the bypass road was completed in early July 2013. This arrangement allowed Elm Avenue to be shut down, but it did not shut down Veneer Road.

Utilities that were to be relocated included a 12-in. water main, and 8-in. water main and a 10-in sanitary sewer force main. WRScompass coordinated their plan for relocating the existing utilities with the City of Portsmouth. Although EA coordinated extensively with the City of Portsmouth's Engineering Department during the remedial design, the City added new requirements during the actual cleanup. These came to light through the Public Works Department when WRS requested closure of Elm Ave to facilitate construction. The City required that steel sleeves be placed around the relocated pipelines where they crossed under the proposed RCP storm drains. The City also required structural reinforcement of pipe joints in the project area. The City's requirements were beyond the original project scope contained in the design and resulted in Contract Modification 4 to WRScompass' subcontract with EA. The utility relocation work began on Elm Avenue on 8 August 2013, but was temporarily halted at the end of the month as work reached Veneer Road due to unstable subsurface conditions and encountered difficulty in keeping one lane of traffic open on Veneer Road. It was at this time that the 3971/3975 Elm Avenue property owner reconsidered, allowing access and came to an agreement with WRScompass for construction of a bypass road across the southwest corner of the 3971 Elm Avenue property that would permit the closure of the entire intersection. This agreement was between WRScompass and the 3971/3975 Elm Avenue property owner, and was not part of the RA contract. WRScompass completed the 3971 Elm Avenue bypass road in early September, and the utility relocation work resumed on 9 September 2013 and was completed by the end of the month.

After the existing utilities were relocated, the installation of JBs 3 and 4 was completed and the new storm drain piping was installed and backfilled. The 3971/3975 Elm Avenue property owner requested that the pre-cast curb inlet on the east side of Veneer Road be shifted slightly to the west so as not to be on his property. EA accommodated this request by specifying a narrower pre-cast structure that fulfilled the intent of the original design yet stayed within the right-of-way and off of the 3975 Elm Avenue property.

Groundwater Collection Trench

During July 2013, while responding to the City's requirements for the utility relocations, WRScompass installed the Groundwater Collection Trench in accordance with the plans and specifications. The trench was completed a few feet short of the design length to keep it out of the temporary by-pass roadway on AMI property. The constructed length of the Groundwater Collection Trench is recorded on the as-built drawings, included with Attachment A.

Roadway Restoration

Following completion of the pipeline installation and backfill, the demolished curb and gutter and sidewalks in the project area were replaced in kind. The roadway surface was then also restored; this paving section consisted of 8 in. of subbase, 3 in. of base course material and 2 in. of surface course bituminous paving. Pavement markings were applied to match the existing features. Inspection of the surface course yielded some rough spots, and the paving subcontractor was called back to make the necessary repairs. These repairs were completed on 22 November 2013 by re-heating the surface course, and adding and compacting a new pavement mixture with fine aggregate only to fill in the voids that were creating the rough spots. This repair was inspected by a Virginia-registered and VDOT-approved professional engineer, who approved the final surface course.

Completion of Onsite Activities

Final grading on the AMI property was completed with the low permeability gravel to provide a smooth surface for AMI to operate on. The grading of the final surface was a change for the design documents, which called for a slight mound around JB 1. However, AMI requested that this area be as flat as possible to improve their operations in this area; EPA agreed to this request and the area was grading accordingly. The grading change resulted in Contract Modification 5 to WRScompass' subcontract with EA, which deleted 900 cubic yards of the low permeability gravel.

Following restoration of the roadway surface, WRScompass graded the soil surface on the north and south sides of Elm Avenue to properly drain towards JBs 3 and 4. The graded areas along Elm Avenue were seeded, mulched, and fertilized, and hay bales were placed around JBs 3 and 4 to restrict silt transport into the new storm drain system until the grass areas are fully vegetated. WRScompass also replaced a chain-link fence on the AMI property in the vicinity of the temporary by-pass road. This fence was removed during the construction of the temporary by-pass road.

The groundwater treatment system was deactivated at the end of October 2013 following backfilling of all pipeline trenches. WRScompass proceeded to clean all the frac tanks and removed them from the site. Creosote from the frac tanks was collected with absorbent pads and booms; these absorbent materials were then contained in supersacks and placed in Stockpile Area A. Additionally, approximately two feet of creosote sludge from the last two frac tanks to be cleaned was mixed with a combination of polymer absorbent, granular absorbents, and Portland cement and placed in Stockpile Area A. Finally, the office trailers were removed from the site to complete the demobilization.

Final Inspections

A pre-final inspection was held on 11 November 2013 with EA and WRScompass staff in attendance; this inspection generated 21 punch list items. WRScompass addressed all but 7 of these items by the final inspection. A final inspection was held with EPA, EA, and WRScompass on 18 November 2013, which generated two additional punch list items.

Attendance at the Final Inspection was as follows:

- Randy Sturgeon, EPA
- Pete Pellissier, EA
- Vince Barber, EA
- Russell Libera, WRScompass
- Ryan Elser, WRScompass
- Eddie Albert, WRScompass

Remaining punch list items were satisfactorily addressed by WRScompass within 1 week of the final inspection. Following verification by EA (Vince Barber) that all final inspection punch list items were satisfactorily addressed, WRScompass demobilized from the site. Copies of the pre-final and final inspection punch lists are included as Attachment B.

As of the date of this RAR, the hay bales along either side of Elm Avenue remain in place. When EA determines that vegetative stabilization has been well established, the hay bales will be removed.

More detailed information concerning construction phase activities is contained in the WRScompass Site Closure Report provided as Attachment A.

2.3 LESSONS LEARNED

The following were the lessons learned associated with the EASDR RA:

- Obtaining all temporary access requirements identified and finalized before they are actually needed would have been beneficial to the project. EPA has existing access agreements with the relevant property owners prior to the RA. However, as construction field events continued, it became clear that major unforeseen site improvements (the construction of temporary access roads) to the AMI and 3971 Elm Avenue properties were necessary to complete the project due to the geometry of the site and unstable subsurface conditions under Veneer Road. Such improvements were not explicitly covered by the existing access agreements and had to be negotiated with AMI and the 3971/3975 Elm Avenue property owner during the construction activities. One of these negotiations (AMI) went smoothly, but the other did not. Difficulties with the 3971/3975 Elm Avenue property owner experienced in May of 2013 impacted the project schedule to a minor degree. Had these negotiations been identified and successfully completed much earlier, the project would have gone much smoother.

- Careful, detailed coordination with the City of Portsmouth and timely action in responding to their requirements would have made the project go much smoother.

3. CHRONOLOGY OF EVENTS

Date	**Event**
December 2007	EPA issues ROD for the AWI Superfund Site. Part of the ROD includes building an offshore sheet pile wall which will form the east side of a containment area for contaminated river sediments. The EASDR project is necessary because the outfall for the existing storm drain system was to the Wyckoff Inlet, which will be filled in as amended contaminated material dredged from the Elizabeth River is placed in Containment Area No. 1.
3 May 2010	EA receives authorization to begin remedial design services at AWI from EPA. This authorization included the design effort for the stormwater management, which includes the EASDR.
8 August 2012	EA completes the remedial design for EASDR
9 August 2012	EA issues Invitation for Bid 12-720 for EASDR construction.
20 August 2012	Pre-bid site walk for potential contractors.
20 September 2012	EA receives construction bids.
19 November 2012	EA issues RA subcontract to WRScompass.
28 November 2012	Pre-construction meeting onsite with low bidder, WRScompass.
2 January 2013	Mobilization to the site begins.
11 November 2013	Pre-final inspection.
18 November 2013	Final inspection.
25 November 2013	Demobilization concludes.
19 December 2013	Erosion and sediment controls partially removed; all onsite work except removal of the hay bales completed.
5 May 2014	EA approves Site Closure Report submittal
9 July 2014	Remedial Action Report completed.

4. OPERATION AND MAINTENANCE

Due to the nature of the EASDR RA construction (all civil or static structural work, and no moving parts), there is essentially no operational and functional period associated with the EASDR RA. The EASDR RA was made necessary by the design, construction, and pending filling of Containment Area No. 1 beginning in 2014, and required that City of Portsmouth-owned storm drains be relocated. EPA envisions that the City of Portsmouth will be responsible for the operation and maintenance (O&M) of the storm drain, but work toward this end has not occurred. EA has only been scoped by EPA to assist the City with their development of an EASDR O&M Manual by developing short O&M procedures for the EASDR. EA will also develop short O&M procedures for the ground water collection trench component of this remedial action. EA understands that a more comprehensive O&M manual for the trench will be developed once EPA determines the extraction and treatment needs for the water in the trench.

It should be noted that the filling of Containment Area No. 1 in 2014 and 2015 may also affect the EASDR and associated O&M activities.

5. SUMMARY OF REMEDIAL ACTION PROJECT COSTS

Table 1 provides a tabulation of actual costs to construct the Elm Avenue Storm Drain Relocation and Groundwater Collection Trench. Costs presented here include the initial cost of EA's RA subcontractor, and an itemized accounting of the various contract modifications made necessary by site conditions or additions and deletions to the scope of work by EPA. EA's onsite supervision, engineering support, management, and closeout costs are presented in Table 2; RA subcontractor general and administrative burden are included as Task 8 under Table 2. Table 3 provides the overall cost to EPA of the EASDR RA (WRScompass plus EA costs).

It should be noted that there was substantially less backfill material needed for the project when the decision was made to make the finished grade as flat as possible to accommodate AMI's operational requirements. This resulted in a credit of over $148,000 as shown in Table 1 below**.** Costs for EA's Resident Inspection (Item 5 in Table 2) were greater than expected due to the project requiring eleven field months to complete versus a planned duration of five months.

Table 1 RA Subcontractor Financial Performance

RA Subcontract Action	Budgeted Costs	Final Cost at Completion
WRScompass initial contract award	$3,279,069.75	$3,279,069.75
Mod 1; Pipe entries into JB #1 and JB #2	$7,025.00	$7,025.00
Mod 2: Remove 330 LF of asbestos pipe	$8,650.00	$8,650.00
Mod 3: Trash grates in JB #1	$19,800.00	$19,800.00
Mod 4: Utility relocation extra work	$234,420.00	$234,420.00
Mod 5: Credit for reduction in grading material	-$36,144.00	-$36,144.00
Credit for underruns on Unit Price Bid Item 9 - Backfill	0	-$148,642.15
Total RA Subcontract Costs	**$3,512,820.75**	**$3,364,178.60**

Table 2 EA's Construction Phase Financial Performance

Task	Budgeted Costs	Final Cost at Completion
1.2 Site-Specific Plan Review	$8.426.67	$0
1.4 Project Management	$16,527.43	$31,223.86
6. Community Involvement	$2,474.00	$0
4. Management Support	$155,015.27	$175,352.86
5. Detailed Resident Inspection	$276,149.84	$343,104.22
6. Data Review	$7,465.42	$5,158.59
8. RA Implementation (EA general & admin. burden only)	$245,897.45	$235,492.50
10. Project Performance	$5,262.00	$0
11. Closeout and Completion	$11,514.47	$20,261.52
12. EASDR RA Closeout	$2,474.00	$2,747.00*
Total EA Construction Phase Costs	**$731,206.55**	**$813,340.55**

*estimated

Table 3 Overall Cost of the EASDR RA

Task	Budgeted Costs	Final Cost at Completion
Total RA Subcontract Costs	$3,512,820.75	$3,364,178.60
Total EA Construction Phase Costs	$731,206.55	$813,340.55
TOTAL COST	**$4,244,027.30**	**$4,177,519.15**

6. EASDR CONTACT INFORMATION

This project was a Federal lead, with EA providing prime RA contractor construction services under the terms of U.S. EPA RAC2 Contract No EP-S3-07-07, WA 030RARA03L2. Following a competitive bid process, EA in turn contracted with WRScompass as their RA subcontractor. Contact information for key individuals associated with the EASDR project is as follows:

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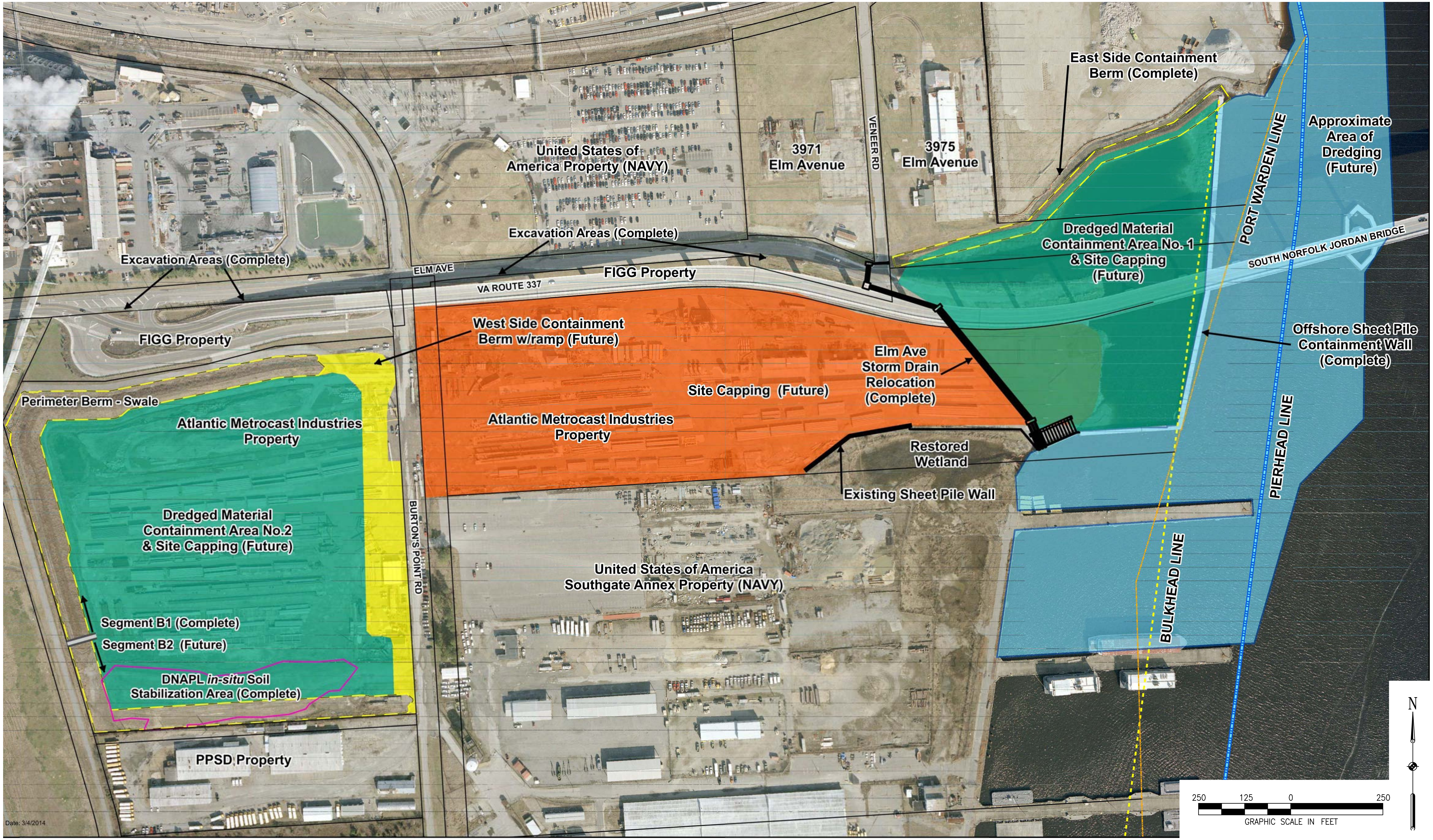
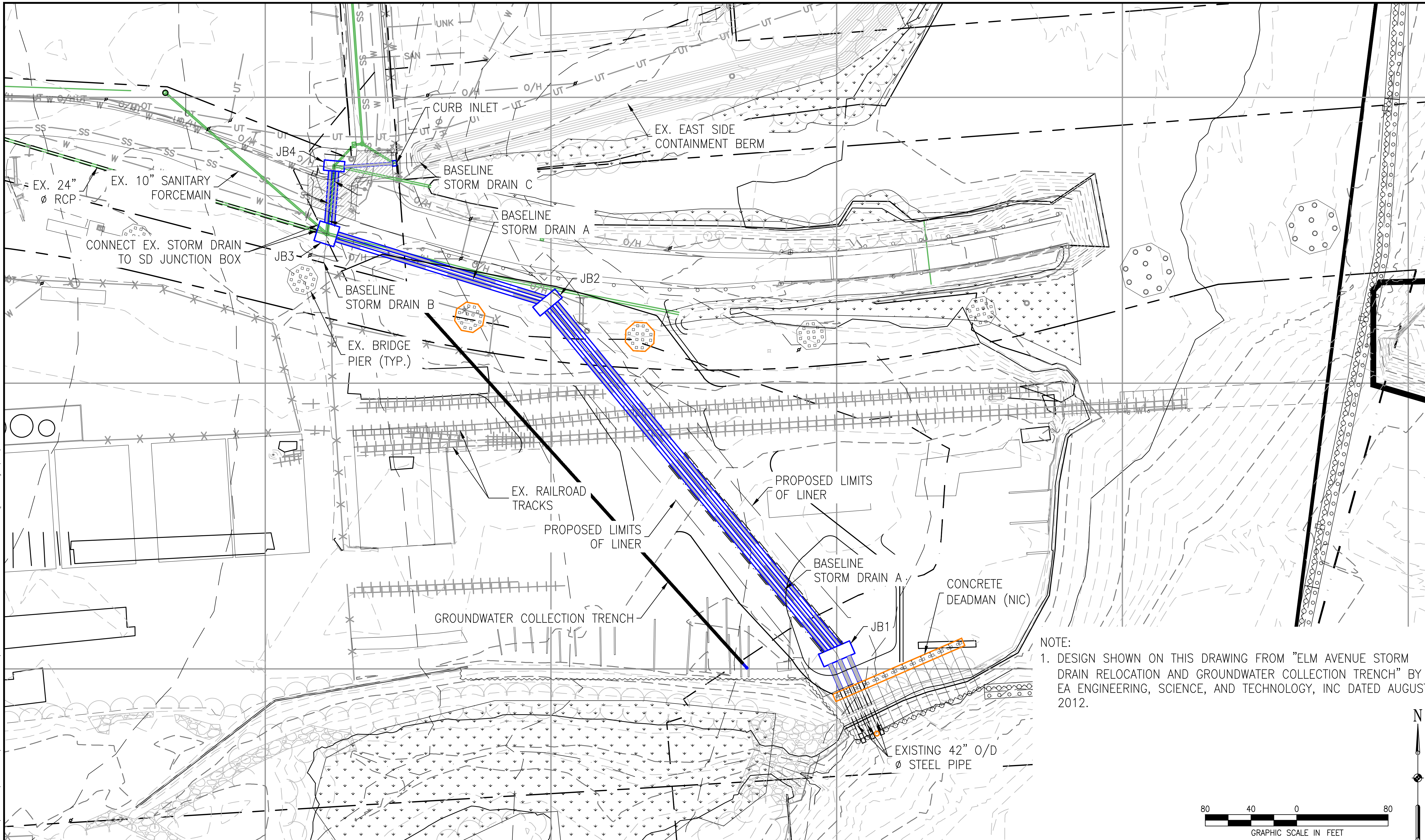


FILE PATH: L:\NON DOD\AWI CAD\PHASE 2\ELM AVE SD RELOCATION\FIGURE 1 - SITE PLAN 2014-3-21.DWG [LAYOUT1] 3/24/14

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	ATLANTIC WOOD INDUSTRIES SUPERFUND SITE PORTSMOUTH, VIRGINIA	ELM AVENUE STORM DRAIN RELOCATION AND GROUNDWATER COLLECTION TRENCH REMEDIAL ACTION REPORT FIGURE 1 OVERALL ATLANTIC WOOD INDUSTRIES SUPERFUND SITE PLAN	DESIGNED BY: JLL	DRAWN BY: JLL	DATE: MARCH 2014	PROJECT NO.: 1453030
			CHECKED BY: PAP	PROJECT MGR.: PAP	DRAWING NO.: –	FIGURE: 1



NOTE:

1. DESIGN SHOWN ON THIS DRAWING FROM "ELM AVENUE STORM DRAIN RELOCATION AND GROUNDWATER COLLECTION TRENCH" BY EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC DATED AUGUST 2012.

FILE PATH: L:\NON DOD\AWI CAD\PHASE 2\ELM AVE SD RELOCATION\FIG 2 - ELM AVE SD RELOCATION.DWG [LAYOUT7] 3/24/14

EA® EA ENGINEERING, SCIENCE, AND TECHNOLOGY	ATLANTIC WOOD INDUSTRIES SUPERFUND SITE PORTSMOUTH, VIRGINIA	ELM AVENUE STORM DRAIN RELOCATION AND GROUNDWATER COLLECTION TRENCH REMEDIAL ACTION REPORT FIGURE 2 DESIGN PROPOSED CONDITIONS PLAN	DESIGNED BY JLL	DRAWN BY JLL	DATE MARCH 2014	PROJECT NO. 1453030
			CHECKED BY PAP	PROJECT MGR. PAP	DRAWING NO. –	FIGURE 2

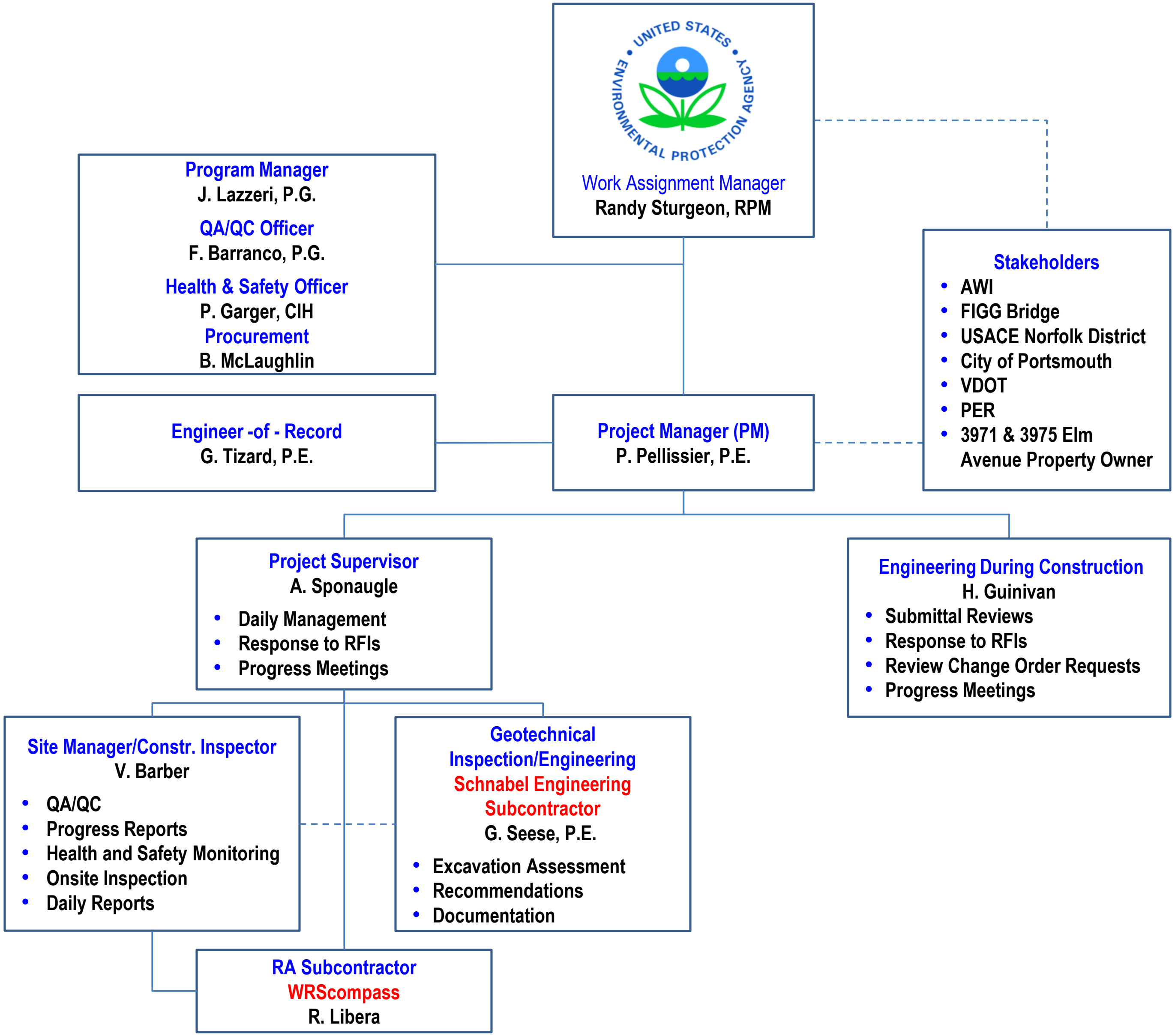


Figure 3

Organization Chart

Elm Avenue Storm Drain Relocation and Groundwater Collection Trench Remedial Action

Atlantic Wood Industries Superfund Site

Portsmouth, Virginia

Attachment A

Site Closure Report

ATLANTIC WOOD INDUSTRIES SUPERFUND SITE
FINAL SITE CLOSURE REPORT

Elm Avenue Storm Drain Relocation and Groundwater Collection Trench
Portsmouth, Virginia
USEPA Contract # - EP-S3-07-07 (Region 3)
EA Solicitation # - IFB-12-720 WRScompass Project # - 33-74-120000

PREPARED BY

WRScompass, Inc.
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for

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May 5, 2014

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Appendix A – Daily Construction Quality Control Reports

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Appendix F – Virginia P.E. Cover Letter

1.0 Introduction

The Atlantic Wood Industries (AWI) Superfund Site is located in the City of Portsmouth, Virginia on the Southern Branch of the Elizabeth River, approximately 7 miles south of the Chesapeake Bay. The project site consists of an industrialized waterfront area surrounded by the Norfolk Naval Shipyard, the former operations center for the Portsmouth Public School District, and several other small industrial properties. Previously, AWI operated a wood treating facility at the site utilizing both creosote and pentachlorophenol as part of their treatment processes. Over time, the site became contaminated from the treatment operation, storage of treated wood, and disposal of generated wastes. In addition, the Navy leased part of the property from AWI and disposed of various wastes on-site, particularly used abrasive blast media and sludge from the production of acetylene. The Elm Avenue Storm Drain Relocation and Groundwater Collection Trench project is located on the AWI site, along with two other properties and the public right of ways on Elm Avenue and Veneer Road. Currently, AWI operates a pre-stressed concrete products manufacturing facility at the site, Atlantic Metrocast Inc. (AMI).

The solicitation/work was offered by EA Engineering, Science, and Technology, Inc. (EA) on August 10, 2012. WRScompass submitted a bid response on September 20, 2012. EA subsequently awarded the work to WRScompass on November 16, 2012. WRS commenced work the week of January 3, 2013 and substantially completed site work on November 24, 2013. The WRScompass project manager returned to the site in early December to complete ancillary work including installation of fences and installation of curb and gutter with sidewalk which was completed on December 20, 2013 under a separate contract with the property owners. This Closure Report concludes the work efforts specified in the original solicitation and associated change orders. The following is a list of modifications to the original contract that were required to successfully complete all phases of the work:

- Stub outs for future storm drain connections to JB 1 and JB 2
- Removal and handling of the 24-inch asbestos containing pipe on the south side of Elm Avenue
- Modifications to the utility relocation required by the City of Portsmouth
- Installation of (3) trash grates on the interior of the south facing wall of JB-1
- Deletion of 900 CY of grading material

All work performed at the site was conducted in accordance with the Davis Bacon Pay Rates and Buy American Act. WRScompass submitted Certified Payroll forms to EA as verification of the DBA obligation.

2.0 Project Scope

In support of EA's Remedial Action Contract 2 with the U.S. Environmental Protection Agency (EPA) Region 3 for the AWI Superfund Site in Portsmouth, VA., WRScompass was contracted by EA to construct/install approximately 800 feet of new storm drain and associated groundwater collection trench. The work scope includes the following:

- Preparation of pre-construction/construction plans and submittals
- Baseline surveys

- Utility mark-out activities
- Clearing and grubbing
- Baseline and perimeter air monitoring
- Erosion and sediment control (silt fencing, berms, diversion dikes etc.)
- Installation of a dewatering system
- Installation and operation of a water treatment system
- Construction of temporary bypass/access roads
- Excavation for the construction of (4) concrete junction boxes (JB-1, JB-2, JB-3 and JB-4) and (1) curb inlet structure
- Installation of triple 42-inch diameter steel pipe south of JB-1 with connection to an existing 42-inch diameter steel pipe at the concrete deadman
- Installation and connection of two or three 36-inch diameter reinforced concrete pipe (RCP) between junction boxes
- Installation and connection of single 24-inch diameter RCP from JB-4 into curb inlet
- Installation of (3) tide flex valves inside JB-1
- Construction of (2) monitoring ports north of JB-1
- Construction of (4) trench drains north of JB-1
- Installation of a 60 millimeter (60 mil.) High Density Polyethylene (HDPE) textured trench liner
- Excavation for the construction of a groundwater collection trench and associated monitoring port
- Excavation for the relocation of existing sewer and water mains at the intersection of Elm Avenue and Veneer Road
- Placement of pipe bedding materials
- Backfill and compact excavated areas in 8 inch lifts
- Final site grading and restoration activities

The relocation of the storm drain is necessary based on additional environmental remedial actions scheduled for the area in the future. All work activities were performed in accordance with the contract specifications and construction plans supplied by EA to WRScompass. WRScompass minimized any environmental pollution or damage during the execution of the site operation activities. WRScompass maintained and managed the site to protect environmental resources within the project boundaries including water, wetlands, private property and the resources located outside the Construction Limits of the site.

3.0 Construction/Remediation Effort

After receiving the Notice to Proceed, WRScompass submitted the required contract plans/documents for approval prior to mobilization. Site work commenced on or around January 3, 2013 and involved (4) separate/continuous phases to ensure the minimum 100 foot access pathway was maintained for the gantry cranes operating at the nearby concrete manufacturing facility. Upon arrival, WRScompass began installation of the site dewatering system which involved the use of well points, header piping, hoses and specialized dewatering pumps to dry the work areas. In order to handle contaminated groundwater generated during the dewatering process, a water treatment system was designed and installed by WRScompass capable of handling approximately 60,000 gallons per day. Initial effluent water samples were collected and shipped to an approved laboratory and analyzed for applicable

Virginia Department of Environmental Quality (VDEQ) discharge parameters. Upon receipt of passing analytical results (below discharge standards), treated water was then released into the nearby Southern Branch of the Elizabeth River.

Phase I (STA. 0+00 to STA. 2+25)

Upon successful setup and operation of the dewatering/water treatment systems, WRScompass proceeded with Phase I activities beginning at the south end of the site working to the north. Phase I activities included the following: excavation; installation of JB-1 (cast in place); installation of (3) tide flex valves; installation of piping (RCP/Steel); installation of non-woven geotextile; installation of 60 mil. textured HDPE liner; installation of anchor trench; installation of trench drains and monitoring ports; installation of select pipe bedding material (VDOT No. 57 Stone); backfilling with select fill material and compaction.

Phase II (STA. 2+25 to STA. 4+50)

Phase II activities included the following: excavation; installation of JB-2 (cast in place); installation of piping (RCP); installation of non-woven geotextile; installation of 60 mil. textured HDPE liner; installation of anchor trench; installation of select pipe bedding material; backfilling with select fill material and compaction.

Phase III (STA. 4+50 to STA. 6+50)

Phase III activities included the following: relocation of the 12-inch water main; excavation; installation of JB-3 (cast in place); installation of piping (RCP); installation of non-woven geotextile; installation of 60 mil. textured HDPE liner; installation of anchor trench; installation of groundwater recovery trench and monitoring port, installation of select pipe bedding material; backfilling with select fill material and compaction.

Phase IV (STA. 6+50 to Completion)

Phase IV activities included the following: excavation; installation of JB-4 (cast in place); installation of curb inlet (pre-cast); installation of piping (RCP); installation of non-woven geotextile; installation of 60 mil. textured HDPE liner; installation of anchor trench; installation of select pipe bedding material; backfilling with select fill material; compacting; reconnection of existing drainage features; reconnection/relocation of existing utilities (sewer and water mains) at the intersection of Elm Avenue and Veneer Road; reconstruction/repaving of Elm Avenue and Veneer Road; decontamination of equipment; site restoration and demobilization.

3.1 Site Conditions

Groundwater was encountered during the excavation of the pipe trenches. Groundwater was controlled using well points with a header pipe connected to a dewatering pump. The contaminated groundwater was treated on site and discharged as previously noted to the Elizabeth River. Additional sumps were also installed to manage the groundwater due to the width of the trench and the distance between the well points across the trench. The sumps were excavated approximately 1 – 2 feet deeper than the excavation bottom with a 2 foot diameter HDPE perforated pipe with #57 stone placed around the pipe. These sumps were removed following the installation of liner materials and the voids were filled with #57 stone.

The excavation included the removal of buried debris associated with previous site operations that included railroad ties and other wooden debris. Debris was excavated from the drainage pipe trench from JB-1 to JB-2 and from the groundwater recovery trench. All excavated debris was transported to Stockpile-A staging area (located on the west side of the AMI property) utilizing off-road dump trucks.

The soil at the floor of the excavations was inspected by Schnabel Engineering (under subcontract to EA) to determine stability for the placement of drainage systems. Schnabel's inspector evaluated the bottom of the excavations prior to the placement of liner materials. Based on the inspection results and the presence of unstable soil, an additional 2 feet of soil was removed from the bottom of the excavations at JB-1 and JB-2 which was filled with rip rap and #57 stone under the foundations of the junction boxes to stabilize the soil. All other areas were deemed suitable and did not require additional stabilization.

The excavation for the installation of the utilities on Veneer Road became unstable. The depth of the excavation was approximately 12 feet below grade with solid material immediately under the street to a depth of approximately five feet and unstable soil from approximately five feet to approximately 10 feet. Firm soil including clay like material was encountered from approximately 10 feet to the bottom of the excavation.

Creosote was encountered during the excavations from JB-1 to JB-4. Groundwater entering into the excavation supported separate phase product entering into the excavations. This material was removed using the dewatering system which pumped the material to the water treatment system. Product was removed from the water at the weir tank using absorbent pads and booms. The spent absorbent booms and pads were placed into cubic yard sacks and subsequently transported to Stockpile A staging area. Based on visual observations, extensive creosote contamination was noted near the JB-4 excavation and the trench from JB-3 to JB-4.

The site conditions varied between dry to wet throughout the duration of the performance of work. Numerous rain events were encountered periodically, heavy at times, that impacted daily work activities. However, the impacts were minimized due to the significant and effective preparations made by WRScompass prior to anticipated inclement weather. Specialized dewatering pumps were strategically placed to divert the discharge from the existing storm drains around areas of construction activities. To help control rain water runoff along areas of construction, WRScompass utilized temporary berms/diversion dikes around the perimeter of open excavations. Additionally, excavation sidewalls were covered with visqueen (polyethylene sheeting) or liner materials to prevent against erosion. This was of significant importance, especially during liner installation activities. Rain events did flood excavations on May 18th and August 10th 2013. Water was pumped from the excavations to the water treatment system without causing any significant impact to the work activities.

3.2 Excavation Logs

Although excavation logs were not formally generated for the site, WRScompass' daily reports indicate efforts and volume calculations for sub-grade materials removed during the project. The daily reports are included as **Appendix A**. The majority of debris and contaminated soils removed from the defined construction areas were transported by (2) off-road dump trucks to the designated Stockpile Area A staging area located west of Burton's Point Road. The debris included, but was not limited to concrete, metal, wood, timber, railroad ties and other miscellaneous materials. In an effort to minimize contamination impacts, visqueen was placed and anchored underneath the trucks to contain any spillage generated during the load out process.

3.3 Volumes Excavated and Placed/Material Quantities

Excavation of contaminated soil quantities removed during construction activities were generated mainly from the construction of the storm drain system, construction of the groundwater collection trench and the relocation/installation of utilities (sewer and water mains) on Elm Avenue and Veneer Road. The following list represents estimated quantities removed for each definable feature of work:

- Storm Drain = approximately 10,521 cubic yards
- Groundwater Collection Trench = approximately 350 cubic yards

The total estimated quantity of contaminated soils removed for the project = 10,871 cubic yards. Excavated materials were transported to Stockpile Area A for disposal. According to information provided, material staged at the Stockpile-A location will eventually be contained under a permanent cap.

The following material quantities were required for the construction of the Storm Drain System, Groundwater Collection Trench and Utility Relocation:

- A total of 2,327.67 tons of low permeability gravel was placed over top of the groundwater collection trench and storm drain system from JB-1 to JB-2 (approximately 1-2 feet in thickness);
- A total of 7,208 cubic yards of select fill material was utilized for backfilling excavated areas in 8 inch lifts;
- A total of 2,797.47 tons of select bedding material (VDOT No. 57 Stone) was utilized for bedding underneath concrete structures and RCP, as well as inside the geotextile fabric associated with the groundwater collection trench;
- A total of 115.57 tons of VDOT 1A rip rap was utilized to create a stable sub base for the construction of a temporary bypass road, underneath JB-1, under JB-2 and underneath the curb inlet on the southeast corner of Veneer Road;
- A total of 595 cubic yards of fill clay material was utilized for stabilization on areas north of Elm Avenue, particularly the north sidewall of the JB-4 excavation, as well as, on the southeast corner of Veneer Road just west of the Wyckoff Inlet where the existing storm drain was removed to prevent water intrusion from the Wyckoff Inlet;
- A total of 1,336.73 tons of VDOT 21A material was utilized to create a stable road base on Elm Avenue and Veneer Road per Hampton Roads Planning District Commission Regional Construction Standards and VDOT Road and Bridge Specifications as applicable;
- A total of 109.16 tons of VDOT BM-25.0 base course asphalt was applied to reconstruct the intersection of Elm Avenue and Veneer Road along with portions of the roads north and west of the intersection;

- A total of 116.67 tons of VDOT SM-9.5A surface course asphalt was applied to the intersection of Elm Avenue and Veneer Road along with portions of the roads north and west of the intersection;
- A total of 166.6 cubic yards of 4,000 psi AE lightweight concrete was utilized for the construction of JB-1, 80 yards for JB-2, 64.5 yards for JB-3 and 45.75 yards for JB-4;
- An estimated total of 12.5 cubic yards of 401 COPRX A-3 concrete was utilized for the construction of sidewalks on the north side of Elm Avenue and east side of Veneer Road; and
- A total of 16.5 cubic yards of 402 COPRX A-3 concrete was utilized for the construction of the curb and gutter along portions of Elm Avenue and Veneer Road.

3.4 Backfill Source(s)

WRScompass utilized two sources for the low permeability gravel, VDOT 1A rip rap, VDOT No. 57 stone, VDOT 21A road base material, select fill, and common fill material. The low permeability gravel, VDOT 1A rip rap, VDOT No. 57 stone and VDOT 21A road base material were sourced from Luck Stone Company located at 4608 Bainbridge Boulevard in Chesapeake, Virginia. The select fill and common fill material were sourced from Currituck Sand & Gravel located at 254 Caratoke Highway in Moyock, North Carolina. The low permeability gravel, VDOT 21A road base, select fill and common fill were chemically and geotechnically tested to ensure the materials met specified parameters conducive to proper construction requirements. Copies of testing results are included in **Appendix B**.

3.5 Chemical and Physical Testing

Specified chemical and physical properties were identified in the contract specifications and tested by approved/certified laboratories (Chemical – Cape Fear Analytical, LLC, Accutest Laboratories and Analytics Corporation; Geotechnical/Physical Properties – McCallum Testing Laboratories, Inc. and Virginia Cooperative Extension; and Geosynthetic – TRI/Environmental, Inc.). Specific details regarding the analytical methods are provided in this report and the results are provided in **Appendix B**.

3.6 Manifesting/Waste Profiling/Waste Recycling/Disposal Documentation

WRScompass completed the project without utilizing any offsite disposal requirement(s) for this contract. All contaminated soils and debris were transported to Stockpile Area A for disposal. As mentioned above, a permanent cap will be constructed in the future to cover/contain these materials. All contaminated groundwater generating during dewatering operations was processed through an on-site water treatment system prior to being discharged into the Elizabeth River.

Suspect asbestos containing materials (ACM) was exposed during the demolition phase of the project. The existing 24-inch diameter RCP just west of the Wyckoff Inlet was exposed and two samples from the pipe were collected which included the pipe material itself and a hard cast-in-place liner. The samples were shipped to Analytics Corporation at 10329 Stony Run Lane, Ashland, VA 23005 for bulk asbestos analysis. The lab is accredited to perform bulk asbestos analysis under National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology (NIST), laboratory number 101004-0. The samples were analyzed by EPA Method 600/M4-82-020 using polarized light microscopy (PLM). The results indicated that chrysotile and crocidolite were present in the gray fiberous portion of the pipe (labeled pipe liner) in concentrations of 20% and 5% respectively.

Based on the visual observation that creosote contamination was present in the pipe and the presence of asbestos in the pipe; the pipe sections were carefully removed, wrapped in plastic sheeting and transported to the Stockpile Area A staging area for temporary storage. In the future, these materials may be required to be disposed of off-site.

WRScompass removed water and sewer utilities from the work area under Elm Avenue and Veneer Road. These pipes were excavated, cut into sections and temporarily stored on site. A total of 17,800 pounds of scrap steel was transported by roll off container to One Steel Recycling in Chesapeake, VA for recycling.

3.7 Fuel Consumption/Sulfur Reduction

WRScompass utilized an estimated 28,140 gallons of dyed, ultra-low sulfur, off road diesel fuel in company owned/rental equipment during construction activities for the project. The fuel was sourced from Miller Oil Company located at 1000 East City Hall Avenue, in Norfolk, Virginia.

4.0 Chemical Data Final Report

4.1 Air Monitoring/Sampling

As part of the AWI site work activities, WRScompass implemented an environmental surveillance program which included real-time air monitoring for personnel, as well as, personal and perimeter air sampling exposure assessments. Air monitoring and sampling activities were performed during impacted soil excavation/removal activities, and as required by specific/specialized work conditions. The objectives of the Field Sampling Plan (FSP) were to verify that concentrations of sampled compounds were below action levels dictated in the Site Specific Health and Safety Plan (SSHASP) and in accordance with the contract Action Air Monitoring Plan (Section 01 35 29.13-1). Sampling was conducted daily at each station for the first three days of excavation activities. Once analytical results were received and concentrations were consistently less than the action levels provided in (Section 11.4) of the FSP, sampling events were reduced to once per week. Analytical results were expedited from the laboratory for the first three days sampling activities. After results were proven to be below action levels, samples were then submitted for standard turn-around times and analyzed for the respective parameters. The air sampling analysis was conducted by Analytics Corporation Laboratory, located in Ashland, Virginia. Analytics Corporation is accredited by the American Industrial Hygiene Association (AIHA).

A primary calibration source was used to perform all calibrations. Air sampling pumps were calibrated to the flow rates in their respective methods prior to each sampling event. Post-sampling calibration was performed as well. The reported sample flow rates were an average of pre- and post-calibration events. Calibrations were performed with representative media in line. Calibration data was recorded on an air sample data sheet and maintained with the sample documentation. All air sampling activities were documented on the WRScompass Air Sample Data Form. Samples were released to a courier and the laboratory on an Analytics Corporation Chain of Custody/ Lab Analysis Request Form. Field blanks were collected at a rate of 10% for air samples. Personal and site perimeter air samples were analyzed by Analytics Laboratories for the analytical methods specified. Air samples were shipped in protective packaging at ambient temperatures and at intervals so that samples were analyzed within 10 business days of collection.

Three sampling stations were established: upwind, downwind and crosswind of contaminated material handling activities. Exact locations were determined in the field and noted on a site plan. Samples were collected at a height of 4 to 6 feet above ground surface. A total of 149 personal and perimeter air samples were collected for site specific air sampling methods over a nine month period for the project. WRScompass conducted additional contingent air sampling when unknown asbestos lined transite pipe was discovered within the limits of disturbance (LOD) on-site. Potential exposures during excavation activities involving the removal of the asbestos transite pipe were characterized via air sampling within the workers breathing zone. Both 8-hour time weighted average (TWA) samples and 30-minute excursion samples were collected. The National Institute for Occupational Safety and Health (NIOSH) Method 7400 sampling and analysis procedure (Phase Contrast Microscopy or PCM) were used for fiber counting. Analytics laboratory accredited by AIHA for asbestos analysis analyzed the air samples. It is common for asbestos projects conducted outside of negative air containment to experience false positive fiber counts due to non-asbestos fibers. The PCM method cannot distinguish between an asbestos and non-asbestos fiber. When one fiber count exceeded the Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) of 0.1 fibers/cc for an 8-hr TWA or 1.0 for a 30-minute excursion sample, WRScompass utilized the NIOSH Transmission Electron Microscopy (TEM) Method 7402 for the sample with the exceedance. The TEM method result was then used to correct the PCM count to reflect only asbestos fibers. The TEM sample results came back with a negative asbestos fiber count.

All air sampling results collected from field work activities were below the environmental site action levels and OSHA PEL standards. Due to the large amount of chemical exposure data generated from the project, the EA Site Inspector and Project Manager were provided with a daily real-time air monitoring summary report, air sampling analytical results and a sample point locations map with summary comparing the air sampling results with the OSHA PELs or the specified environmental ambient air monitoring levels outlined in the contract (Table 01 35 29.13.1) included as part of the CO daily submittal Quality Assurance/Quality Control (QA/QC) reports. A summary of the site-specific methods are listed below:

Personal Air Sampling Requirements		**Perimeter Air Sampling Requirements**	
Compound	Test Method	Compound	Test Method
Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	NIOSH 1501M	Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	NIOSH 1501M
Coal Tar Pitch Volatiles (PAHs)	OSHA Method 58	Polynuclear Aromatic Hydrocarbons (PAHs)	NIOSH Method 5506
Pentachlorophenol (PCP)	OSHA Method 39M	Pentachlorophenol (PCP)	OSHA Method 39M
Arsenic and Lead	OSHA Method 125G	Arsenic and Lead	NIOSH Method 7300M ICP-MS
Asbestos	NIOSH 7400	Asbestos	NIOSH 7400

The real-time exposure monitoring performed onsite was used to determine if engineering controls were functioning properly and/or when personnel needed to upgrade/downgrade the level of PPE in accordance with the Site Action Air Monitoring Plan. Real-time air monitoring equipment utilized at the site included a photoionization detector (PID > 10.2 eV) for ionizable compounds, a particulate monitor (pDR-1000) for dust and a 4-gas meter equipped with sensors for % LEL, O2, CO and H2S for confined space entries. All air monitoring equipment was calibrated daily, prior to use, in accordance with the manufacturers' specifications. The real time monitoring action limits are provided in the table below.

REAL TIME MONITORING ACTION LIMITS FOR PERSONNEL

Instrument/Method	Action Level	Specific Action	Max. Cartridge Service Life*
pDR-1000 (equivalent) for particulate	**(sustained for 5 min)** $\geq$ 2.5 mg/m^3 $\geq$ 5.0 mg/m^3	Implement Engineering Controls Stop Work, Evaluate Controls	Not Applicable Not Applicable
PID for Total volatile organics	**(sustained for 5 min)** $\geq$ 10 ppm above background $\geq$ 50 ppm $\geq$ 100 ppm	Upgrade to Level C Upgrade to Level B Stop Work	8 hrs. or breakthrough Not Applicable Not Applicable
%O2	< 19.5% O2 > 23%	Stop Work, Evacuate area Stop Work	Not Applicable
%LEL	$\geq$ 10 % LEL $\geq$ 20 % LEL	Stop work, implement engineering controls and continuous monitoring Evacuate area	Not Applicable
H2S	**(sustained for 1 min)** $\geq$ 10 ppm	Stop Work and Leave Area; Evaluate Potential Sources; Do Not Reenter Until Further Safety Precautions Are Established	Level B if work must resume at concentrations above 10 ppm

Two types of dust control measures were utilized to mitigate the threat from inhalation hazards associated with airborne dust. The first dust control measure was the use of engineering controls which involved watering of site haul roads/excavations and misting during the removal of asbestos transite pipe. The second dust control measure was personnel protection in the form of full face respirator's and appropriate PPE. No exceedances were documented or observed throughout the project at concentrations requiring an adjustment/modification to the in-place engineering controls or project PPE for excavation or other field work activities, except for confined space entries needed to decontaminate the water treatment holding tanks. Level B PPE work was required inside the water treatment holding tanks due to elevated volatile organic compound (VOC) levels. WRScompass performed continuous air monitoring of entrant crew members throughout the tank cleaning operations and downgraded PPE based on site action levels specified in the SSHASP. Due to the duration of this project, a large amount of chemical data was produced at the site and for brevity of this report, no air sampling or real-time air monitoring tables have been provided in this section of the report. However, the environmental surveillance data with summary reports are included in the QA/QC reports provided in **Appendix A**.

The project environmental air surveillance analysis results were all at safe levels and met the requirements for the specifications for the project air quality assurance monitoring program. Daily environmental air monitoring assessment results were provided to the EA CO in written notification through the daily QA/QC submittal reports.

4.2 Soil and Water Sampling and Analysis

Chemical testing was required for the pipe trench construction project, which included the sampling and testing of the imported fill materials and the water samples from the water treatment system. An additional sample was collected from the tidal water control pump that pumped tidal water from the ballast rock filled area adjacent to the concrete deadman used to anchor the sheet pile wall.

Laboratory analysis was performed by Accutest Laboratories of New Jersey (Accutest) and by Cape Fear Analytical LLC (Cape Fear) of Wilmington North Carolina. Certified laboratory analytical reports are included as part of this Closure Report in **Appendix B**.

4.2.1 Imported Fill Materials

The contract requirement to chemically test any backfill source material was achieved and is illustrated herein. The select fill (sand) and the common fill (clay) were tested by visiting the source and obtaining an un-biased sample(s) of the two materials at the Currituk Sand & Gravel pit. The samples were placed in a cooler and shipped to the labs. The contract requirements called for the source material(s) to be tested for arsenic (total), benzo(a) pyrene, and dioxin toxicity equivalent (TEQ) parameters. The holding times (As – 180 days, TEQ – 30 days, and benzo(a)pyrene – 14 days) for each parameter was not exceeded prior to analysis. The borrow source samples were collected on March 8, 2013, received by the lab March 9, 2013, along with the first weekly effluent sample collected from the water treatment system. The analytical parameters, test methods, laboratory and target concentrations are noted in Table 4.2.1.1

Table 4.2.1.1 – Analytical Methods Imported Fill Materials

Parameter	Test Method	Laboratory	Target concentration
Arsenic	EPA Method 6010	Accutest	< 30 ppm
Benzo(a)pyrene	EPA Method 8270	Accutest	< 0.5 ppm
Dioxin TEQ	EPA Method 8290	Cape Fear	< 1 ppb

4.2.2 Water Samples

Water samples were collected from the water treatment system prior to discharge. Samples were collected from the system for three consecutive days for rush turn around analysis to evaluate the effectiveness of the treatment system for each phase. The treated water generated during the 3-day testing phase was contained in frac tanks on site and was not discharged until results were within discharge criteria and approved for discharge. Following a demonstration that the water met discharge limits, the treated water was discharged to the drainage ditch located on the south side of Elm Avenue. Water that did not meet discharge criteria was pumped through the treatment system again once it was demonstrated that the system was adjusted and was capable of meeting discharge standards. Following the pumping test, water samples were then typically collected on a weekly basis for standard turn-around time. The testing parameters, analytical methods, laboratory and target concentrations are noted in Table 4.2.2.1.

Table 4.2.2.1 – Analytical Methods Water Samples

Parameter	Test Method	Laboratory	Target concentration (µg/L)
Total Suspended Solids	SM 20 2540D	Accutest	NR
Total Dissolved Solids	SM 20 2540C	Accutest	NR
Sulfide	SM 20 4500	Accutest	NR
Chloride	EPA 300/SW846 9056	Accutest	NR
Sulfate	EPA 300/SW846 9056	Accutest	NR
Aluminum	EPA 200.7/SW846 6010C	Accutest	NR
Arsenic	EPA 200.7/SW846 6010C	Accutest	36
Chromium	EPA 200.7/SW846 6010C	Accutest	74
Hexavalent Chromium	SWA846 7196A/SM19 3500CRD	Accutest	11
Cadmium	EPA 200.7/SW846 6010C	Accutest	1.1
Copper	EPA 200.7/SW846 6010C	Accutest	6
Iron	EPA 200.7/SW846 6010C	Accutest	NR
Lead	EPA 200.7/SW846 6010C	Accutest	14
Manganese	EPA 200.7/SW846 6010C	Accutest	NR
Mercury	SW846 7470A	Accutest	0.77
Vanadium	EPA 200.7/SW846 6010C	Accutest	NR
Zinc	EPA 200.7/SW846 6010C	Accutest	81
Benzene	EPA 624 or EPA 8260	Accutest	510
Xylenes	EPA 624 or EPA 8260	Accutest	NR
1,1' Biphenyl	EPA 625 or EPA 8270	Accutest	NR
2,4,6- Trichlorophenol	EPA 625 or EPA 8270	Accutest	24
2,4-Dichlorophenol	EPA 625 or EPA 8270	Accutest	290
2,4-Dimethylphenol	EPA 625 or EPA 8270	Accutest	850
2-Chlorophenol	EPA 625 or EPA 8270	Accutest	150
2-Methylnaphthalene	EPA 625 or EPA 8270	Accutest	NR
2-Methylphenol (o-creosol)	EPA 625 or EPA 8270	Accutest	NR
4-Methylphenol (p-creosol)	EPA 625 or EPA 8270	Accutest	NR
Acenaphthene	EPA 625 or EPA 8270	Accutest	990
Benzo(a)anthracene	EPA 625 or EPA 8270 SIM	Accutest	0.18
Benzo(a)pyrene	EPA 625 or EPA 8270 SIM	Accutest	0.18
Benzo(b)fluoranthene	EPA 625 or EPA 8270 SIM	Accutest	0.18
Benzo(k)fluoranthene	EPA 625 or EPA 8270 SIM	Accutest	0.18
bis(2-ethylhexyl)phthalate	EPA 625 or EPA 8270	Accutest	22
Carbazole	EPA 625 or EPA 8270	Accutest	NR
Dibenzofuran	EPA 625 or EPA 8270	Accutest	NR
Fluorene	EPA 625 or EPA 8270	Accutest	5300
Indeno(1,2,3-cd)pyrene	EPA 625 or EPA 8270 SIM	Accutest	0.18

Parameter	Test Method	Laboratory	Target concentration (µg/L)
Naphthalene	EPA 625 or EPA 8270	Accutest	NR
Pentachlorophenol	EPA 625 or EPA 8270	Accutest	6.7
Phenanthrene	EPA 625 or EPA 8270	Accutest	NR
Pyrene	EPA 625 or EPA 8270	Accutest	4000
4,4'-DDT	EPA 608 or EPA 8081	Accutest	0.001
alpha-BHC	EPA 608 or EPA 8081	Accutest	0.049
beta-BHC	EPA 608 or EPA 8081	Accutest	0.17
delta-BHC	EPA 608 or EPA 8081	Accutest	NR
gamma-BHC	EPA 608 or EPA 8081	Accutest	0.16
Dieldrin	EPA 608 or EPA 8081	Accutest	0.00054
Heptachlor Epoxide	EPA 608 or EPA 8081	Accutest	0.00039
TCDD/TCDF Conginers	EPA 1613	Cape Fear	5.0×10^{-8}
Hardness, Total	SM19 2340C	Accutest	NR

Notes: NR – not regulated

4.3 Summary of Field and Laboratory Activities

4.3.1 Imported Fill Analysis

Two samples of the imported fill materials to be used on the project, labeled clay and select fill (Currituck) were collected on March 8, 2013 for the following analytical methods:

Arsenic Method – 6010C (solid)
Benzo(a)pyrene Method – 8270D / Prep Method – 3550C (solid)
TEQ Method – 8290A (solid)/Prep Method 3540C

The analytical results are summarized in Table 4.3.1.1 and 4.3.1.2

Table 4.3.1.1 – Analytical Summary Results - Clay

Parameter	Analytical Results	Reporting Limit	Method Detection Limit	Target concentration
Arsenic	ND	2.2 mg/kg	1.4 mg/kg	< 30 ppm
Benzo(a)pyrene	ND	33 µg/kg	10 µg/kg	< 0.5 ppm
Dioxin TEQ	9.15 pg/g	NA	NA	< 1 ppb

Notes: ND = not detected
NA = Not applicable
pg/g = picogram per gram (parts per trillion)

Table 4.3.1.2 – Analytical Summary Results – Select Fill

Parameter	Analytical Results	Reporting Limit	Method Detection Limit	Target concentration
Arsenic	ND	2.1 mg/kg	1.3 mg/kg	< 30 ppm
Benzo(a)pyrene	ND	35 µg/kg	11 µg/kg	< 0.5 ppm
Dioxin TEQ	0.694 pg/g	NA	NA	< 1 ppb

Notes:	**ND = not detected**
	NA = Not applicable
	pg/g = picogram per gram (parts per trillion)

Based on a review of the analytical results, the samples met the target concentration criteria. A review of the QA data indicated that the samples were extracted and analyzed within holding times and all method blanks were within acceptance criteria. The sample matrix spike (MS) and matrix spike duplicate (MSD) had surrogates that were outside of the outside of control limits due to matrix interference which should not impact the validity of the results based on other supporting QC data.

4.3.2 Water Treatment System Discharge Analysis

The chemical laboratory analysis of the discharge water was provided by the laboratory with a two to three week turn-around time on the weekly samples. These results were then summarized on a table and compared to discharge standards approved for the site under the Water Control Plan. The analytical summary tables, laboratory reports and electronic data deliverables (EDD) were submitted for review. Pending review, adjustments were implemented to the water treatment program which included replacement of GAC or the zeolite used to absorb contaminants. Copies of the analytical reports, analytical summary tables and electronic data deliverables are included in Appendix B.

The analytical summary tables included in Appendix B have been modified from the original submittals to include data qualifiers. The data qualifiers and their definitions are summarized below:

E	The reported value exceeds the calibration range
J	Estimated value between the reporting limit and the method detection limit
B	Analyte was found in the associated method blank
K	Estimated maximum possible concentration
ND or U	Analyte was not detected above the specified detection limit

Analytical reports were provided with quality control summarizes for each sample that was analyzed. The QC summaries, case narratives and sample receipt reports were reviewed to determine the acceptability of the results. Slight deviations were noted for QC data such as trace contaminants in the method blanks, low spike recoveries and matrix spike duplicates that were out of acceptable range for a limited number of parameters, however in none of the reported QC data were results that indicated the data was not usable.

Other QC issues that were noted included the following:

Week 4 - sulfide was analyzed outside of holding time
Week 19 – hexavalent chromium was analyzed outside of holding time
Week 22 – total dissolved solids was analyzed outside of holding time

The analytical programs were also adjusted to address water treatment concerns, specifically polycyclic aromatic hydrocarbon (PAH) break through. Upon receipt of an analytical report that exceeded the discharge standards, the treated water would be retained and the treatment system would be serviced. Once changes were implemented, a sample would be collected and analyzed on a rush basis to confirm that the system was meeting discharge standards. Therefore the sample collected on Week 28 was analyzed for PAHs. Additional adjustments were implemented to the system including the use of a 0.5 micron high-efficiency filter installed on prior to Week 29 and a 2000 pound polishing carbon filer installed prior to week 30. The samples collected on Weeks 29 and 30 were labeled Post-Filter and Post-Polishing Filter, respectively.

4.3.3 Tidal Water Sample

A water sample was collected from the discharge of the tidal water removal pump. The water was pumped from the ballast rock area located to the south of JB-1 adjacent to the existing deadman, which is the area infiltrated by river water. The water was pumped from a sump and was discharged to the lagoon enclosed by the sheet pile wall from a turbidity bag. A sample of the water was collected on February 7th 2013. The sample was analyzed for volatile organics by EPA Method 624, semi-volatile organics by EPA 625, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, silver selenium, tin, zinc and hexa-valent chromium. These results were compared to previous samples collected from related tidal water pumping projects. Based on this comparison, the water was approved for discharge into the containment lagoon.

4.3.4 Pipe Water

A water sample was collected from the eastern-most 42-inch diameter steel pipe located in JB-1. The sample was collected to verify the quality of the water contained in the pipe. The water sample was collected by placing a ½ inch diameter PVC pipe under the tide flex valve and collecting the water sample from the open end of the pipe. The sample was collected for the same analytical suite as the weekly discharge samples. Based on the analysis, cadmium, copper, lead and zinc were detected above the discharge standards. PAHs were not detected in the sample and all other contaminants were not detected or were below discharge standards.

5.0 <u>Decontamination/Dewatering/Water Treatment Operations</u>

5.1 Personnel Decontamination

During the construction/installation of the storm drain and groundwater collection trench, soil and groundwater contamination was encountered. WRScompass made every effort to minimize worker exposure to identified contaminants while working inside designated exclusion zones. All personnel entering the exclusion zones were required to wear the appropriate level of personal protective equipment (PPE) for the type and function of work being performed and the expected environmental conditions. The majority of work was performed in Level D/D+ PPE, with the exception of frac tank decontamination/cleaning operations, which were performed in Level B PPE. WRScompass provided and maintained a designated decontamination station in the control zone of each exclusion zone as work progressed. The decontamination station included boot washes, eye washes, water, soap, trash cans, liners, etc. Spent PPE was transported to Stockpile Area A for disposal.

5.2 Equipment Decontamination

A designated decontamination pad was constructed to the west of the water treatment plant utilizing earthen berms, stone and visqueen. The visqueen was used to line the bottom and sidewalls of the pad to prevent contaminated wash water from contacting clean surfaces. All heavy equipment and other rental/owned equipment were gross (dry) cleaned, followed by pressure washing each unit prior to demobilization. Decontamination efforts were recorded on an equipment decontamination verification form which included such information as type of contamination, equipment description, serial number, color, attachments, and decontamination methods. Water from the decontamination station was pumped to the water treatment plant for treatment.

The frac tanks contained contaminated water including untreated water that was pumped from the excavation areas to the frac tanks for storage when the water treatment system was overwhelmed by rain events or when water treatment system adjustments were being implemented. The untreated water left a residue on the interior of the tank walls that was removed during the decontamination phase of the project. High pressure washers and high pressure steam cleaners were used in conjunction with chemicals to remove the contaminants from the tanks. The water generated from these activities was treated in the water treatment system

Toward the end of water treatment operations, accumulated viscous sludge material was observed on the bottom of the weir box and three of the on-site frac tanks. Two of the three frac tanks were utilized to contain contaminated water (pending treatment) and the remaining tank was utilized to contain groundwater that was pumped directly from the groundwater recovery trench excavation. On November 9, 2013 the following sludge measurements were collected and recorded from the bottom of the weir box and frac tanks:

- Weir Box – Approximately 28-inches – approximately 3,500 gallons of sludge and sediment
- Frac Tanks (3) – Less than 18-inches – approximately 3,000 gallons in each tank

A total of 12,500 gallons of viscous sludge material was pumped from the frac tanks into the weir box and solidified with 5,797 pounds of Super Absorbent Polymer (SAP) from Zappa Tec, a polyacrylate that binds with water to make a solid material. Blending was performed by applying the SAP and mixing with the bucket of the excavator. After the viscous sludge material was sufficiently solidified, the material was loaded into off road dump trucks with lined beds. Contaminated soil from the Stockpile Area A was placed in the back of the truck to protect the tail gate, then the sludge was loaded into the bed and the load was transported to Stockpile Area A and mixed with site soils.

5.3 Dewatering/Water Treatment Operations

The dewatering/water treatment systems operated 24 hours per day, 7 days per week from approximately 2/12/13 to 10/25/13. However, the water treatment system was reactivated on 11/8/13 to treat wash water generated from frac tank decontamination/cleaning activities and shut off on 11/11/13. During the period of operation, 2,502,347 gallons of water was treated and discharged into the Elizabeth River.

5.4 Water Treatment Methodology

The on-site water treatment system was designed to treat up to 60,000 gallons of contaminated groundwater per day, although the system was not operated at that flow rate in order to maintain a higher contact time with the treatment media. The system consisted of a weir tank, frac tanks, carbon/zeolite cells, filtration units, pumps, and hoses. Water entering the dewatering system was pumped into a weir tank where solids were allowed to settle out and separate phase product was removed. From the weir tank, water was then pumped into a 20,000 gallon frac tank, through an oil/water separator, aeration tank, bag filter apparatus, a series of carbon and zeolite cells, and a polishing filter apparatus before being discharged into the Elizabeth River. During the water treatment process, bag filters were routinely replaced and contaminated bags were placed into approved containers for transportation to the Stockpile Area A staging area.

During the operation of the system, weekly sample reports were reviewed, typically three weeks following collection of each sample. Maintenance of the system was performed including replacement of the carbon and zeolite when break-through occurred. WRScompass provided additional carbon cells to quickly switch water treatment equipment to allow continuous water treatment. New treatment cells were introduced on April 1st, July 23rd (carbon), July 25th (zeolite), September 4th, and added a polishing carbon cell on September 21st. All the carbon and zeolite cells were removed and the carbon cells were pressure washed at the end of the water treatment system operational period. Spent carbon and zeolite generated from water treatment operations was also transported to Stockpile Area A as appropriate. Initially, 3,000 lbs. of spent carbon was contained in cubic yard sacks from the first carbon change out in April; however carbon was blended with contaminated soils from the excavations and transported in bulk to Stockpile Area A as it was noted that the excavated soil was already saturated with DNAPL materials, especially as the excavation proceeded from JB-2 to the curb inlet on Veneer Road. The total amount of carbon and zeolite that was blended with the soil was 10,000 lbs. of carbon and 4,000 lbs. of zeolite. These materials were placed in the contaminated soil piles at Stockpile Area A and was eventually covered with contaminated soil from continuing soil excavation activities.

6.0 Water Level Monitoring (Junction Box 1 to Station 5+25)

In an effort to saturate the select fill material and select bedding inside the pipe trench per contract specification (Section 31 00 00, Paragraph 3.5.2), WRScompass added clean/potable water from the hydrant located on Elm Avenue. Water was added to the trench via a fill port location just south of JB-2 and from the two storm drain monitoring ports north of JB-1. Water level measurements were collected daily from the two storm drain monitoring ports north of JB-1, as well as temporary observation wells located at Stations 1+25, 3+75 and 5+25. Additionally, water level measurements were collected from two temporary observation wells located outside the liner at Station 3+75 (east and west of the lined trench). Water level measurements were collected between July 10th and November 18th 2013, at which point the required elevation of +3.5 was achieved and water flowed from the storm trench monitoring pipe into JB-1, signifying saturation of the pipe trench. Daily water level measurements and a well location map are included as **Appendix C**.

7.0 Unanticipated Impacts to Construction/Events

7.1 Impacts to Construction

Three unanticipated impacts to construction delayed the progress of site work activities, particularly during the installation/relocation of utilities (sewer and water mains) on Elm Avenue and Veneer Road. The first impact was the discovery that the existing 24-inch diameter RCP to be removed was an asbestos-containing material (ACM) pipe. The pipe was exposed and was found to be suspect ACM, so samples of the pipe and the liner were collected and sent to the lab for verification. Based on the results, chrysotile and crocidolite were reported in the samples. EA issued Contract Modification 2 for $8,650 to WRScompass to remove the pipe and handle it as ACM.

The second was due to the requirement of the City of Portsmouth to install pipe sleeves for all the utility lines relocated under the proposed storm drainage piping. The construction plans required relocating the utilities one foot below the liner at each location where they intersected the drainage pipe trench and the utility lines were to be replaced with HDPE pipe. The City of Portsmouth Department of Engineering required that any of the pipes installed under the new storm drainage lines be placed in a 24-inch diameter sleeve for future access if needed. Due to the diameter of the sleeve, the utilities were lowered an additional two feet to accommodate the design requirements (one foot clearance), based on the 24 inch diameter of the sleeve. Due to these requirements, EA issued Contract Modification 4, which provided WRScompass with an additional $234,420 and 46 calendar days to the project schedule.

The third unanticipated impact to construction was due to roadway closure issues. Excavation and installation of the drainage system and the utilities under Elm Avenue and Veneer Road were to be performed while maintaining at least one open traffic lane on each roadway. WRScompass made numerous efforts to work without closing the roadways, but was unsuccessful. As alternatives, WRScompass proposed possible weekend roadway closures, specialized road plates and trench boxes and evaluated adjacent properties for possible traffic detours. Based on evaluation of the proposed features and limitations of the roadways, detours using adjacent properties were considered the most suitable alternative. Use of the unimproved service road on Atlantic Metrocast Inc. (AMI) property and the open lot on the northwest corner of Elm Avenue and Veneer Road owned by Mr. Dwight Dixon were considered the best alternatives. Mr. Dixon would not agree to using his property, but AMI agreed to the use of their roadway as a detour which allowed the closure of Elm Avenue only. The work was initiated which included the relocation of the existing water and sewer mains and installation of JB-3 and JB-4.

During excavation activities for the sewer and water main relocations on Veneer Road, WRScompass and EA observed cracking of the asphalt caused by an inadequate/unstable sub-base comprised of unsuitable soils below the existing road bed materials. Due to concerns that the excavation walls would collapse and permanently close the road, excavation activities for the installation of utilities on Veneer Road were halted until a resolution could be reached. The unstable sub-base conditions identified further demonstrated / exemplified the need for full roadway closure prior to continuing the utility relocation activities on Veneer Road. In the interim, additional trench boxes and steel road plates were utilized to brace the excavation sidewalls. Due to the depth of the utility excavations as noted in the above paragraph and the limited space for the placement and use of the wide trench boxes to accommodate both utility lines and pipe fusing equipment, utility work could not be restarted until the roadway closure issue was resolved. In late August 2013, Mr. Dixon, after several denials, finally allowed use of his property after witnessing the unsuccessful efforts by WRScompass in completing the utility relocation activities while continuing to maintain an open traffic lane on Veneer Road through the construction area. By gaining access to the Dixon property, WRScompass was able to construct a temporary by-pass northwest of the Elm Avenue /Veneer Road intersection which relieved the constraints for roadway closures.

7.2 Incidental Contaminated Water Releases

During dewatering/water treatment operations every effort was made to minimize and control potential contaminated water releases. The systems were continuously monitored 24 hours per day, 7 days per week, and were routinely inspected for leaks or signs of equipment failure; however, WRScompass did experience a few minor release events. The majority of the releases originated from degraded hoses that were impacted from exposure to creosote contamination. The water generated by these release events was immediately contained and absorbed with clean sand and/or applicable absorbent materials and transported to Stockpile Area A for disposal.

7.3 Installation of Weko Seals

Between October 16, 2013 and October 18, 2013, WRScompass addressed water intrusion impacts into the storm drainage system through the 42-inch steel pipes just south of JB-1 and north of the outfall to the Elizabeth River. Internal repairs were performed by Chesapeake Bay Diving utilizing (3) Miller Pipeline Weko Seals. Based on the site conditions present (i.e. creosote contamination and salt water application) nitrile rubber seals with stainless steel bands were utilized. All work was conducted under the direct supervision of a qualified Miller Pipeline representative to ensure the seals were properly installed in accordance with the manufacturer's specifications. After installation, the seals were pressure tested per the manufacturer's instruction and inspected for leaks; no leaks were found.

8.0 Site or Task Specific Employee Personal and Respiratory Protection

All construction work was conducted in Level D respiratory protection. Decontamination of the frac tanks was conducted in Level B respiratory protection due to the elevated concentrations of hydrocarbons in the tank atmosphere. The following key personnel were associated with the site as depicted.

- Greg Sulon – Program Manager
- Russell Libera – Project Manager & Site Manager
- Scott Garpiel – Site Manager
- Marc Syracuse – Site Manager
- Ralph Malone – Foreman/Site Manager
- Lee Butler – Foreman/Site Manager
- Brandon Wilson – Quality Control Manager
- Todd Conley – Quality Control Manager
- Ryan Elser – Quality Control Manager
- Larry Endicott – H&S Officer

- Edward Albert – H&S Officer
- Dennis Malucci – Water Treatment Foreman

9.0 Summary and Recommendations

The installation of the Elm Avenue Storm Drainage System and Groundwater Collection Trench was completed in accordance with the project design specifications supplied by EA to WRScompass. The drainage piping was installed per the manufacturer's recommendations, and in conformance with common industry practice/standards. Pipes were placed within an HDPE-lined trench to protect from the surrounding contaminated soil and contaminated groundwater intrusion, and bedded with No.57 stone. Junction boxes were cast-in-place in sections in the following sequence: (1) foundation; (2) walls; and (3) top. Additionally, a pre-cast curb inlet was installed that replaced the existing structure on the east side of Veneer Road completing the drainage system infrastructure. These construction activities were documented, monitored and summarized in this Site Closure Report.

During construction activities an estimated total of 10,871 cubic yards of contaminated soils/debris were transported and staged at the designated Stockpile Area A location. As mentioned above, WRScompass discovered ACM during the demolition phase of the existing 24-inch diameter RCP storm drain. Every precaution was taken when removing the identified piping to minimize potential personnel exposure. After removal, the pipe was wrapped in plastic sheeting and transported to the Stockpile Area A for disposal either onsite or for relocation to an offsite disposal location as deemed necessary by the EPA.

The dewatering system required significant maintenance during the project, which included periodic Granular Activated carbon (GAC) change outs based on chemical breakthrough, specifically PAHs. The system was operated within the designed flow rates; however, the contaminants greatly impacted the effectiveness of the system. Additionally, storm events and flooding also impacted the capacity of the system at various stages throughout the project, which required additional water storage capacity. It should also be noted that the dewatering system consisted of hoses to allow flexibility for moving equipment and relocating the hoses to accommodate construction. During the period of operation, 2,502,347 gallons of water was treated and discharged into the Elizabeth River.

Prior to the final acceptance inspection, a pre-inspection was conducted on November 11, 2013 involving EA and WRScompass. From the pre-inspection walk through an itemized punch list was generated of task items incomplete to date. WRScompass addressed and completed all of the outstanding task items in a timely manner as required by contract. At the conclusion of site work activities, a final acceptance inspection was conducted on November 18, 2013 at the project site including representatives from the EPA, EA and WRScompass.

WRScompass recommends designing a larger capacity treatment system that includes a larger weir tank and using an HDPE-lined storage tank or open pool instead of frac tanks to contain surges during rain events. Increasing the capacity to treat water should also be considered which would include larger carbon cells for any future work at the site involving dewatering support. Additionally, any long term dewatering project should use HDPE piping with limited use of hoses as needed.

Appendix A

Daily Construction Quality Control Reports

Appendix B

Chemical and Physical Test Reports

Appendix C

Pipe Trench Water Level Measurements and Well Location Map

Appendix D

Site Photographs

Appendix E

Record Drawings (Field Markups/As-Built Drawings)

Appendix F

Virginia P.E. Cover Letter

Attachment B

Final Inspection Punch Lists

	Atlantic Woods Superfund Site		
	Elm Avenue Storm Drain Relocation and Groundwater Collection Trench		
	Pre-Final Inspection	**11:00 AM**	**11/11/2013**
	Conducted by: Pete Pellissier		**Page 1 of 2**
	Attendees: Russell Libera (WRScompass), Ryan Elser (WRScompass), Vince Barber (EA), Pete Pellissier (EA)		
	Item	***Date Identified***	***Date Completed***
1	JB #1 area: Replace inner caps on all three monitoring wells (broken gaskets)	11/11/2013	
2	Groundwater Collection Trench - two western-most bollards need cleaning and painting.	11/11/2013	
3	JB #1: trash gates: western-most gate latch needs lubricating	11/11/2013	
4	General: Final Site Grading needs to be completed	11/11/2013	
5	GWTP: Two frac tanks need to be emptied of sludge, cleaned and taken offsite	11/11/2013	
6	North of GWTP: Pipe removed from Elm Avenue as part of utility relocations needs to be take to Stockpile Area A.	11/11/2013	
7	Pipeline Trench: Remove temporary well points (3 inside liner and 2 outside liner)	11/11/2013	
8	JB #2: Replace rusty pistons on access doors	11/11/2013	
9	JB #2: Sand and finish paint bollards	11/11/2013	
10	General: Restore overhead electrical line across Veneer Road to three existing light poles.	11/11/2013	
11	JB #3 and JB #4: remove interior formwork and install grates	11/11/2013	
12	Veneer Road: Replace "W" manhole cover with "S" manhole cover	11/11/2013	
13	General: Finish grade area west & south of JB #3, seed & mulch.	11/11/2013	
14	Roadway: install binder and surface pavement courses	11/11/2013	
15	General: Form and install sidewalk north of Elm Avenue	11/11/2013	
16	General: Demobilize trailers and equipment	11/11/2013	
17	General: Flood Trench to Elevation 3.5 feet per Spec Section 31 00 00, Page 11, Paragraph 3.5.2	11/11/2013	
18	General: Replace chain link fence on AMI property south of gravel access road	11/11/2013	
19	Veneer Rd: Repair chain link fence on east side of Veneer Rd.	11/11/2013	
20	Veneer Road: Repair small dent on curb on west side of Veneer Road (small patch)	11/11/2013	
21	Veneer Road: Remove temporary plug in curb inlet of west side of Veneer Road.	11/11/2013	

Weather: Sunny, 60 Degrees

	Atlantic Woods Superfund Site		
	Elm Avenue Storm Drain Relocation and Groundwater Collection Trench		
	Final Inspection	**11:00AM**	**11/18/2013**
	Conducted by: Pete Pellissier		**Page 1 of 1**
	Attendees: Randy Sturgeon (EPA), Russell Libera (WRScompass), Ryan Elser (WRScompass), Vince Barber (EA), Pete Pellissier (EA), Chris Evans (VDEQ- observing only)		
	NOTE: Items from the Pre-final Inspection Punch List that were not completed at the time of the Final Inspection are repeated here for completeness.		
	Item	***Date Identified***	***Date Completed/Notes***
1	General: Final Site Grading needs to be completed (from Pre-Final Inspection)	11/11/2013	11/21/2013
2	GWTP: One frac tank remains to be emptied of sludge, cleaned, and taken offsite (from Pre-Final Inspection)	11/11/2013	11/25/2013
3	General: Restore overhead electrical Line across Veneer Road to three existing light poles (from Pre-Final Inspection)	11/11/2013	Dominion has been contacted; they will schedule field work
4	General: Demobilize trailers and equipment (from Pre-Final Inspection)	11/11/2013	11/25/2013
5	General: Flood trench to elevation 3.5 per Spec Section 31 00 00, page 11, Paragraph 3.5.2 (from Pre-Final Inspection)	11/11/2103`	11/18/2013
6	Install sidewalks (from Pre-Final Inspection)	11/11/2013	11/18/2013
7	Add soil between JB #4 and USACE Trailers to make finished ground surface higher than sidewalks	11/18/2013	11/20/2013
8	Roadway: Randy Sturgeon expressed concern about the smoothness of the surface course of the roadway paving, and requested that EA/WRScompass look into what could be done.	11/18/2013	11/22/2013
9	Veneer Road: Remove temporary plug in curb inlet on the west side of Veneer Road (from Pre-Final Inspection)	11/11/2013	11/19/2013
10	Final Inspection concluded at 12:10 PM		
11			

Weather: Sunny, 65 degrees